

The Hourglass Is Half Full or Half Empty: Temporal Framing and the Group Planning Fallacy

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Three studies tested hypotheses that temporal frames influence the group planning fallacy and are associated with subjective distance to deadlines and thoughts about successful task completion. Temporal framing effects occurred even though actual times to deadlines were held constant. In Study 1, groups predicted course project completion. Those adopting little time remaining frames exhibited less planning fallacy than those adopting lots of time remaining frames. Little time remaining frames were related to deadlines feeling closer and to fewer thoughts about success. Study 2 replicated this finding using a laboratory assembly task. Study 3 further indicated that it is whether thoughts about success come to mind easily, not thought content, that produces this effect; thoughts about success also led to deadlines feeling closer.

Keywords: temporal framing, planning fallacy, predictions, debiasing, groups

Time is a resource. Organizations, businesses, universities, and governments among many other groups spend a considerable amount of effort attempting to accurately predict how long projects will take to complete. Bad planning can have far-reaching consequences, being costly in terms of money, jobs, prestige, or even lives. Large-scale planning debacles abound, supplying poignant public illustrations of overly optimistic group plans gone awry (Flyvberg,

Holme, & Soren, 2002; Hall, 1980; Schnaars, 1989). For example, the Sydney Opera House, begun in 1957, was originally estimated to be completed in 1963, but a scaled-down version actually opened in 1973—a decade late. The Eurofighter aircraft, conceived jointly by Britain, Germany, Italy, and Spain, was originally planned to be operational in 1997, but the first aircraft were not delivered until 2003. Boston's Central Artery/Tunnel project was originally estimated to be completed in 1999, but it is currently expected to be fully completed in early 2006.

This *planning fallacy*, a bias in underestimating the time it will take to finish tasks, is not limited to megaprojects. It is also found on a wide variety of ordinary personal activities including completing household chores, school assignments, holiday shopping, and laboratory tasks (Buehler, Griffin, & Ross, 1994; Byram, 1997; Kahneman & Tversky, 1979; Kruger & Evans, 2004; Newby-Clark, Ross, Buehler, Koehler, & Griffin, 2000; Sanna & Schwarz, 2004; Taylor, Pham, Rivkin, & Armor, 1998). First, our main goal was to test the novel hypothesis that *temporal frames*—implying that either a little or a lot of time is available for task completion—can influence planning estimates,

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even though objective target dates or deadlines are held constant. Second, we did this in the context of groups. Despite the opening examples, little emphasis thus far has been placed on examining completion time predictions of groups. Third, we tested perceived temporal distance and accessible thoughts about successful task completion as possible mechanisms for this effect, with a view toward applications of debiasing techniques. We report three studies using multiple contexts, manipulations, and measures.

Group Planning Fallacy

Planning and prediction are ubiquitous to groups. In fact, several definitions of groups begin with the explicit presumption that members are brought together to accomplish particular tasks (Kerr & Tindale, 2004; Levine & Moreland, 1998; Parks & Sanna, 1999; Stangor, 2003), and thus, predicting when those tasks will be completed is critical to effective functioning. Despite this emphasis, planning fallacy researchers thus far have focused mainly on plans of individual persons rather than groups. One goal of our research was to fill this gap. Research on individuals provides ample evidence for the planning fallacy in everyday life. For example, in one seminal study, Buehler et al. (1994) found that students underestimated the time it would take them to finish an honors thesis. People are similarly overly optimistic when predicting the completion of other academic tasks (Newby-Clark et al., 2000; Sanna & Schwarz, 2004; Taylor et al., 1998), personal and laboratory tasks (Buehler et al., 1994; Byram, 1997; Kruger & Evans, 2004), and tax returns (Buehler, Griffin, & MacDonald, 1997).

There may be many reasons for the planning fallacy. On large-scale megaprojects, one explanation is simply political or commercial. That is, agencies want to maintain optimistic convictions that targets are attainable in order to receive approval and funding (Flyvberg et al., 2002; Hall, 1980). However, perhaps more psychologically meaningful, one of the most heavily supported explanations for the planning fallacy is that planners adopt a singular, or *inside*, perspective that focuses mainly on scenarios of successful task completion; this contrasts with a distributional, or *outside*, perspective that takes into account past failures (Kahneman & Tversky, 1979). Several studies are generally consistent with ideas derived from the

inside–outside explanation. For example, the planning fallacy can result from people focusing too narrowly on successful future plans (Buehler & Griffin, 2003; Kruger & Evans, 2004; Sanna & Schwarz, 2004) while failing to adequately consider relevant negative past experiences in which their optimistic plans did not transpire (Buehler et al., 1994; Newby-Clark et al., 2000).

One main implication of the inside–outside explanation is that inducing people to take more of an outside perspective can lessen or eliminate the planning fallacy. For example, having participants predict someone else's task completion time rather than their own—that is, having people take an outside or distributional perspective—can reduce the planning fallacy (Buehler et al., 1994). This particular point has a special relevance for group planning, because predictions can be influenced not only by individuals who may be taking an inside perspective but also by other group members who can provide an outside perspective. Our research examining the degree to which the planning fallacy does or does not occur in groups thus becomes a critically valuable extension of the planning fallacy literature. The question of whether the planning fallacy occurs in groups is additionally important for the more general reason that although in many cases groups might be susceptible to the same biases as individuals, in other cases they might not be (Hinz, Tindale, & Vollrath, 1997; Kerr, MacCoun, & Kramer, 1996).

Temporal Framing

We also tested the novel hypothesis that temporal frames can influence the predicted task completion times of groups. This was done with the additional aim of potentially using temporal framing as a debiasing technique. Specifically, we predicted that framing tasks in terms of *a little* versus *a lot* of time available for completion might affect group planning estimates. In other words, inducing groups to construe the hourglass as half empty, versus half full, may attenuate the planning fallacy. This begins with framing ideas (Tversky & Kahneman, 1981); for example, participants read that the United States is preparing for an Asian disease that may kill 600 people. Plans to combat the disease are framed in terms of people saved (200 certainly saved vs. one third chance all saved and two thirds chance all die) or people dying (400 cer-

tainly die vs. one third chance no one dies and two thirds chance all die). Though probabilities are equivalent, participants choose the risk-averse option (200 certainly saved) when framed positively (in terms of people saved) but choose the risky option (one third chance no one dies and two thirds chance all die) when framed negatively (in terms of people dying).

Framing effects occur by changing psychological reference points. In the Asian disease problem, the referent in the positive frame is the number of people saved; in the negative frame, it is the number dying (Fagley & Miller, 1990; Levin, Gaeth, Schreiber, & Lauriola, 2002; McElroy & Seta, 2003; Tindale, Sheffey, & Scott, 1993). Our suggestion is that time can be analogously framed. As Paese (1995) observed, "any activity that has an *expected duration* can be temporally framed from either of two points of view: its starting point or its stopping point" (p. 68). Deadlines or target dates are an index of available time (Gersick, 1999; Waller, Conte, Gibson, & Carpenter, 2001). Building on starting and stopping point ideas, we hypothesize that predicted task completion times can be estimated in at least two ways, with very different psychological implications: (a) Groups can begin with the starting point as a referent and then move forward in time (e.g., "If we begin today, we still have 3 months left to finish"); or (b) groups can begin with the stopping point as a referent and then move backward in time (e.g., "Given the deadline, we only have 3 months left to finish"). In the former instance, the starting point ("today") becomes the referent, and as people move forward in time when making predictions, they will perceive that there is lots of time still remaining. In the latter case, the stopping point ("deadline") becomes the referent, and as people move backward in time when making their predictions, they will perceive that there is only a little time remaining.

Applied to estimated task completion times, we predict that *negative* temporal frames implying little time remaining (e.g., "Given the deadline, we only have 3 months left to finish") will attenuate or eliminate the group planning fallacy relative to *positive* temporal frames implying lots of time remaining (e.g., "If we begin today, we still have 3 months left to finish"). This would be supported by smaller discrepancies between predicted and actual task completion times for groups in the former condition than in the latter. Moreover, we attempt to pro-

vide strong evidence for temporal framing effects in our research by holding constant actual target dates or deadlines. We note that our framing ideas are also related particularly to goal framing, one of three types of framing effects (the other two types being risky choice [e.g., the Asian disease problem] and attribute; Levin et al., 2002). Goal framing emphasizes relations between cognitions and goal attainment. For example, negative goal frames implying a 50% failure rate versus positive goal frames implying a 50% success rate have stronger influences on people's judgments and behaviors (Krishnamurthy, Carter, & Blair, 2001; Meyerowitz & Chaiken, 1987; Rothman & Salovey, 1997; cf. Levin et al., 2002). Possible mechanisms underlying the group planning fallacy are elaborated in the next section.

Overview of Present Research

We conducted three studies. Our prediction was that negative temporal frames implying little time remaining would attenuate (or eliminate) the group planning fallacy relative to lots of time remaining frames, even though actual time to deadlines was held constant. We also predicted that deadlines should feel *subjectively* closer in little time remaining frames and that this would be associated with difficulty in bringing to mind thoughts about successful task completion. In Study 1, groups predicted when they would finish a course project, and their prediction was then compared with their actual completion time. They rated the perceived distance of deadlines and the degree to which thoughts about success were easily brought to mind. Thus, we hoped to test our hypotheses in response to real-life events. In Study 2, using a laboratory assembly task, we conceptually replicated and extended Study 1 while enabling greater experimental control. In addition, in Study 2 we obtained another measure of thoughts about successful task completion and also tested whether framing of the prediction question mattered.

Study 3 focused further on identifying possible underlying mechanisms. To do this, we relied on ideas about *accessibility experiences* (ease of thought generation) and *accessible content* (topic of thoughts) (Schwarz, 1998). For example, Schwarz et al. (1991) found that participants rated themselves as *less* assertive after being asked to recall 12 examples of assertive-

ness, experienced as difficult, rather than only 6 examples, experienced as easy, even though the former task brought to mind twice as many examples. In short, finding it difficult to generate many examples, people conclude that there cannot be many examples or else it would not be so difficult to bring them to mind. These obtained effects are opposite to what would be expected on the basis of thought content alone. In Study 3, we varied ease of thinking about successful task completion and thought numbers factorially while examining influences on the group planning fallacy. Prior planning fallacy research has thus far emphasized only the content of people's thoughts (e.g., Buehler et al., 1994), and thus our research adds to the literature by also testing whether accessibility experiences can further qualify observed effects. We predicted that the group planning fallacy would occur only when thoughts about successful task completion are easily brought to mind. In contrast, when thoughts about successful completion are difficult to bring to mind, the group planning fallacy should be reduced or eliminated.

Studies 1 and 2 examined how manipulated temporal frames may influence the subjective experience of deadlines and accessible thoughts about success. Study 3 tested an intriguing opposite possibility, whether ease of thinking about successful task completion can reciprocally influence the perceived closeness of deadlines. As we described previously, several theorists have suggested that narrowly focusing on successful task completion produces the planning fallacy. Adding to this, research in other areas also suggests that thinking about success is most difficult when tasks are proximal (Gilovich, Kerr, & Medvec, 1993; Sanna, 1999; Shepperd, Ouellette, & Fernandez, 1996). Reversing this, we explored whether difficulty in thinking about successful task completion is also associated with deadlines feeling subjectively closer and whether this is related to lessened group planning fallacy. In short, obtaining a consistent pattern of findings across all three studies while at the same time using diverse settings, manipulations, and measures would provide strong support for our hypotheses.

Study 1: Mispredicted Term Projects

Our first study provided an initial test of our hypotheses by taking advantage of a real-life

academic task for participants (Newby-Clark et al., 2000; Sanna & Schwarz, 2004): completing a course assignment (Buehler et al., 1994). Groups predicted when they would finish, and their prediction was compared with actual task completion. Before groups made predictions, we manipulated temporal frames by asking some groups to consider the little time remaining and others to consider the lots of time remaining. In addition, we included a control condition for comparison purposes in which temporal frames were not manipulated. We predicted that temporal frames implying little time remaining would attenuate or eliminate the group planning fallacy relative to a lot of time remaining frames. Reduced group planning fallacy should be accompanied by deadlines feeling subjectively proximal and thoughts about successful task completion being difficult to bring to mind. Of importance, temporal frames should influence the group planning fallacy even though objective time to completion (i.e., the deadline) was held constant across conditions.

Method

Participants

Participants were 196 introductory marketing students who took part in class projects in randomly assigned groups of four and who were randomly assigned to frame condition. The number of students initially enrolled in the course ($n = 229$) allowed us to begin with 56 four-person groups (and 1 five-person group that was excluded from the study). The final number of 49 groups resulted from some students dropping the course, absences on prediction day, and a group in one condition not completing the project before the semester ended.¹

Procedure

Students, working in groups, were required to write a research proposal as part of the course. Topics for projects were selected from a list, but

¹ This group was in the lots of time remaining frame condition. As it turned out, there were extenuating circumstances: 1 student in this group disenrolled from the university because of the death of a close family member, and another was called to military service. Accommodations were later made for the 2 remaining students in this group.

approval from the instructor was necessary. The purpose of the research proposal, and its formatting, was discussed in detail during the 3rd week of the semester. This essentially involved writing a 15–20-page paper, including an introduction and method section, modeled after one of the many articles read in class. Students were assigned to four-person groups and were told that the project's deadline was in exactly 12 weeks (2 weeks before the end of the semester). The deadline represented the last possible date projects would be accepted, but it was emphasized that projects could be handed in any time before then.

Temporal Frames

Groups predicted their task completion times after research proposals were described. To do this, students were divided into groups to read and discuss the instructions, and they made predictions jointly as a group. Each group was reminded of the proposal deadline, 12 weeks hence. The groups read that because their class was so large, their teaching assistants and instructor would need to prepare and coordinate in order to grade the research proposals. Thus, they were told, an estimate of when their group planned on finishing their projects would be very helpful. Groups in the little time remaining frame condition ($n = 16$ groups) read the following:

Before making predictions, we ask that you first take a few minutes to think about the fact that, given the deadline, you only have about three months left to finish your research proposal. That is, you only have 12 weeks remaining before your research proposal must be handed in.

Groups in the lots of time remaining frame condition ($n = 15$ groups) read the following:

Before making predictions, we ask that you first take a few minutes to think about the fact that, beginning today, you still have about three months left to finish your research proposal. That is, you still have 12 weeks remaining before your research proposal must be handed in.

Groups in the control condition ($n = 18$ groups) did not receive any framing manipulations.

We thus attempted to get groups in the former frame condition to focus on the stopping point (deadline) as a referent and to get them to move backward in time to perceive only a little time remaining; in the latter frame condition, we

attempted to get groups to focus on the starting point as a referent (today) and to get them to move forward in time to perceive lots of time remaining. The control condition was included for comparison purposes.

Dependent Measures

The dependent measures were completed jointly as a group. Questions asking about predicted task completion, subjective temporal distance, and accessible thoughts about success were completed at the initial session 12 weeks before the deadline. These were answered after temporal framing manipulations. Actual task completion times were assessed directly by the researchers when finished research projects were turned in.

Predicted task completion. Groups were given calendars on which to indicate predicted task completion times. The calendar was presented all on one page and began with the first day of classes and ended with the last day of classes. Four events were marked on each calendar: (a) first day of class, (b) today, (c) proposal deadline, and (d) last day of class. Groups were asked to mark on the calendar the exact date and time they planned to turn in the proposal.

Actual task completion. Actual task completion times were measured by when the finished research proposals were turned in. Dates and times were recorded by either a teaching assistant or the course instructor.²

Subjective temporal distance. Groups answered two questions regarding the degree to which the deadline felt subjectively close or far away on 11-point scales (1 = *feels very close*, 11 = *feels very far away*; and 1 = *feels very near*, 11 = *feels very distant*).

Accessible thoughts about success. Two questions represented the degree to which it was easy for groups to think about possible successful and unsuccessful task completion. Groups responded to one question asking about suc-

² We chose to use the time at which research proposals were turned in as a measure of task completion because it was objectively verifiable and because groups were specifically asked to predict when they planned to *turn in* their proposals. However, we also asked groups to write on their proposals the exact date and time it was completed. The pattern of data using groups' self-reported task completion time was identical to that reported in the text.

successful task completion and one question asking about unsuccessful task completion; responses to both questions were made on 11-point scales (1 = *difficult to bring to mind*, 11 = *easy to bring to mind*).

Results and Discussion

Data were analyzed using one-way analyses of variance (ANOVAs), with post hoc tests for mean comparisons. Means and standard deviations are presented in Table 1.

Task Completion Time

We predicted that little time remaining frames would attenuate or eliminate the group planning fallacy relative to lots of time remaining frames and that this would be shown by smaller discrepancies between predicted and actual task completion times in the former condition than in the latter. The group planning fallacy was indexed by subtracting predicted from actual task completion times, with greater differences indicating less accurate estimates. Task completion times were converted to number of days (and fractions thereof) before the deadline.

The mean difference between predicted and actual task completion times diverged across frame conditions, $F(2, 46) = 11.18, p < .001$. As predicted, the mean difference in the little time remaining frame was less than in the other two conditions (Tukey's honestly significant difference test [HSD], $ps < .01$), whereas the lots of time remaining and control conditions did not differ from each other. Analyzed sepa-

rately, the framing manipulations affected group predictions, $F(2, 46) = 7.22, p = .002$, but left actual task completion times unaffected ($F < 1$).

Subjective Temporal Distance

Little time remaining frames should leave deadlines feeling subjectively closer than lots of time remaining frames, even though actual time to the deadline was equivalent for all groups. The two temporal distance questions were averaged, $r(47) = .67, p < .01$, revealing a difference among frame conditions, $F(2, 46) = 5.03, p = .011$. As predicted, deadlines in the little time remaining condition felt closer than in the other two conditions (Tukey's HSD, $ps < .05$), whereas the lots of time remaining and control conditions did not differ from each other.

Accessible Thoughts About Success

We predicted that groups would find it more difficult to think about successful task completion in the little time remaining condition. The two questions assessing thoughts about successful and unsuccessful task completion were averaged, $r(47) = .61, p < .01$; the question assessing thoughts about unsuccessful task completion was first reverse coded. There was a difference among frame conditions, $F(2, 46) = 4.88, p = .012$, with thoughts about successful task completion being more difficult to bring to mind in the little time remaining condition than in the other two conditions (Tukey's HSD, $ps <$

Table 1
Task Completion Time (Days Before Deadline), Subjective Temporal Distance, and Accessible Thoughts About Success by Temporal Frames for Study 1

Measure	Temporal frame					
	Control ^a		Lots remaining ^b		Little remaining ^c	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Task completion time						
Difference	5.19	2.39	5.86	2.89	1.88	2.34
Predicted	8.25	2.43	8.40	3.03	5.31	2.31
Actual	3.05	2.37	2.53	2.25	3.43	2.24
Subjective temporal distance	8.00	3.25	8.66	2.74	5.50	2.80
Accessible success thoughts	7.72	3.02	7.80	2.54	4.93	2.94

Note. Difference = actual minus predicted task completion time.

^a $n = 18$ groups. ^b $n = 15$ groups. ^c $n = 16$ groups.

.05). The lots of time remaining and control conditions did not differ from each other.

In summary, results supported hypotheses that temporal frames influence the group planning fallacy, and this is related to subjective temporal distance and accessible thoughts about successful task completion. Little time remaining frames attenuated the group planning fallacy, whereas lots of time remaining frames and the control condition did not differ from each other (perhaps suggesting that groups naturally adopt lots of time remaining frames when predicting). Our idea that accessible success thoughts influence the planning fallacy is bolstered further by mediational analyses (Kenny, Kashy, & Bolger, 1998). Temporal frame condition was contrast coded (control = 0, lots remaining = 1, little remaining = -1). First, regressing task completion time (difference) on temporal frame was significant ($\beta = .45, p < .001$). Second, regressing accessible success thoughts on temporal frame was significant ($\beta = .32, p = .026$). Third, regressing task completion time on both accessible success thoughts and temporal frame revealed success thoughts to be significant ($\beta = .66, p < .001$), along with temporal frame ($\beta = .24, p = .021$). Most important, the relationship between task completion time and temporal frame was significantly reduced with accessible success thoughts included (Sobel's $z = 2.16, p = .03$). This provides evidence consistent with at least partial mediation as we predicted. We emphasize that temporal frames influenced the group planning fallacy—groups mispredicted the term of their term projects—even though actual time deadlines were held constant for all groups.

Study 2: Some Assembly Required

Study 1 provided initial support for our hypotheses in a real-life situation. However, one possible trade-off of using a real-life setting—as in most such studies—was that a host of uncontrolled variables were likely introduced. For example, we relied on the time at which groups turned in their term projects as a measure of task completion (cf. footnote 2); it is also possible that some groups could have chosen topics that simply turned out to be inherently more difficult than they initially seemed. Although we could argue that random assignment to frame condition probably diminishes many if not all of these concerns, we thought that it would nonetheless

be valuable to try to replicate our findings in a more controlled laboratory context. In other words, on the one hand, the results of Study 1 could be considered particularly impressive because they were obtained despite the possibility of uncontrolled variability; on the other hand, the procedures of Study 1 could have introduced other unknown factors that might have affected our results in some indeterminate way.

Study 2 was designed to address these concerns by conceptually replicating Study 1 in a controlled laboratory setting while also examining some additional issues. First, we standardized the task by asking all groups to assemble a computer desk, a procedure modeled after prior research using individuals (Byram, 1997). Pilot testing had shown this task to be engaging, and it mimics many of the qualities of tasks performed by real-life groups. Second, we were able to measure not only group predictions but also the exact time at which groups completed the tasks. Third, three temporal framing conditions were adapted from Study 1. Fourth, we varied the framing of the prediction questions (Buehler & Griffin, 2003); although question framing did not influence predictions in prior research, that research did not first manipulate the framing of time remaining, as we did. Some groups were asked simply to predict when they would finish (as in Study 1), whereas other groups were asked to predict how far in advance of the deadline they would finish. Given our general interest in framing effects, the issue of question framing seemed worth exploring further. Despite these procedural changes, our hypotheses were essentially identical to those in Study 1.

Method

Participants

A total of 102 students enrolled in undergraduate organizational behavior courses received extra credit and were randomly assigned to 34 three-person groups.

Procedure

Groups arrived at the laboratory and predicted how long it would take them to assemble a computer desk, and then they actually assembled it. They were randomly assigned to one of

three temporal frame conditions. The experimental sessions were scheduled for 2 hrs. There were no clocks present in the laboratory room, and any timepieces (e.g., watches) were collected from participants at the start of the session.

Computer Desk Assembly Task

We asked groups in our research to assemble the Studio (Model RTA-18858) Saturn Centre computer desk. Dimensions of the fully assembled desk were 41 in. (104.14 cm) high, 47 in. (119.38 cm) wide, and 28 in. (71.12 cm) deep. It included a base shelf, main work-surface area, monitor shelf, keyboard tray, and two smaller side shelves. Several features of the desk made it useful for our research. It could be assembled using a “cam-lock system” that did not require any additional tools. Assembly was fairly straightforward though not trivial (the desk contained 22 pieces), and it could be completed in under 1 hr.³ It had explicit, detailed, step-by-step instructions, with discrete beginning and ending points. Instructions included drawings of each component part and descriptions of how the parts should be put together.⁴

Temporal Frames

Manipulations of temporal frame were modified from Study 1. All groups were told they had 1 hr in which to put together the computer desk. Each group was given the full desk instructions and accompanying diagrams, which included a photo of the completed computer desk. In addition, all parts were organized and arrayed on tables across the rear of the laboratory room. Groups in the little time remaining frame condition ($n = 11$ groups) read the following:

Before making predictions, we ask that you first take a few minutes to think about the fact that, from when this task ends, you only have an hour in which to assemble the computer desk. That is, you only have 60 minutes remaining.

Groups in the *lots of time remaining* frame condition ($n = 11$ groups) read the following:

Before making predictions, we ask that you first take a few minutes to think about the fact that, from when this

task begins, you still have an hour in which to assemble the computer desk. That is, you still have 60 minutes remaining.

Groups in the control condition ($n = 12$ groups) did not receive framing manipulations.

Again, we thus attempted to get groups in the former frame condition to focus on the stopping point as a referent, whereas in the latter frame condition, we attempted to get groups to focus on the starting point as a referent. The control condition was included for comparison.

Dependent Measures

As in Study 1, dependent measures were completed jointly as a group, and actual task completion time was assessed directly by the researchers.

Predicted task completion. Groups were given a sheet with an analog clock face, on which 60 minute indicators and the numerals 1–12 were positioned. The 12 represented the beginning and ending point of the task and was labeled with *start* and *finish*. Commencing with 1, the dial was also labeled with elapsed time (i.e., 1 = 5 min, 2 = 10 min, etc.). Groups were asked to predict their task completion time by making a mark along the perimeter of the clock face.

In addition, we explored whether framing of the prediction question made any difference. Half of the groups were asked simply to predict when they would finish the assembly task (control, $n = 6$; lots remaining, $n = 6$; little remaining, $n = 5$), whereas the other half predicted *how far in advance* of the 1-hr deadline they would finish (Buehler & Griffin, 2003).

Actual task completion. Actual task completion time was measured precisely and unobtrusively by the experimenter using a stopwatch.

³ Pilot testing had indicated that in the absence of any experimental manipulations, three-person groups ($n = 5$) took an average of 51 min ($M = 51.82$, $SD = 7.21$) to assemble the computer desk.

⁴ Three identical computer desks were used in Studies 2 and 3. This allowed for the possibility of running multiple sessions at the same time and also allowed us time to disassemble the desks between sessions. Once the two studies were completed, the names of our research assistants were entered into a lottery and the desks were raffled off (retail value \$114.99). The winners were contacted and all three enthusiastically acquired their desks.

Table 2
Task Completion Time (Minutes Before Deadline), Subjective Temporal Distance, and Listed Thoughts About Success by Temporal Frames for Study 2

Measure	Temporal frame					
	Control ^a		Lots remaining ^b		Little remaining ^c	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Task completion time						
Difference	7.58	6.78	9.81	5.21	1.72	4.92
Predicted	42.41	4.44	41.27	5.10	48.45	4.90
Actual	50.00	6.36	51.09	6.22	50.18	6.25
Subjective temporal distance	6.58	2.10	6.90	2.34	4.18	1.77
Listed success thoughts	16.00	4.49	16.27	4.33	11.72	3.69

Note. Difference = actual minus predicted task completion time.

^a $n = 12$ groups. ^b $n = 11$ groups. ^c $n = 11$ groups.

Subjective temporal distance. Subjective temporal distance was measured as in Study 1.

Listed thoughts about success. For added generality, we made one other change. We asked groups in Study 2 to list thoughts about successful task completion, instead of using rating scales as in Study 1. Groups were given a page with 25 lines (they could use the back if needed) and were asked to “use the spaces below to list as many thoughts about successful task completion as come to mind.” They were allowed 8 min to list as many thoughts as they could (pilot testing had indicated that 8 min was sufficient for groups to perform this thoughts-listing task). The listed thoughts should generally represent those that come to mind easily.

Results and Discussion

Data were analyzed using one-way ANOVAs and post hoc tests for mean comparisons. Means and standard deviations are presented in Table 2.

Task Completion Time

Following Study 1, the group planning fallacy was indexed by subtracting predicted from actual task completion times. Recall that in Study 2 we also explored whether the framing of predicted task completion questions mattered. However, consistent with prior research (Buehler & Griffin, 2003), preliminary analyses indicated that question framing made no difference ($p = .82$); for ease of exposition, we thus simply added together and averaged the two

types of predicted task completion time questions.⁵ Actual task completion times of the groups were converted to number of minutes (and fractions thereof) before the 1-hr deadline.

As predicted, and consistent with Study 1, mean differences between predicted and actual task completion times differed by temporal frame, $F(2, 31) = 5.85, p = .007$. The mean difference in the little time remaining frame was less than in the other two conditions (Tukey’s HSD, $ps < .05$), whereas the lots of time remaining and control conditions did not differ from each other. Analyzed separately, temporal frames once again affected group predictions, $F(2, 31) = 7.12, p = .003$, but they did not affect actual task completion times ($F < 1$).

Subjective Temporal Distance

The two subjective distance questions were averaged, $r(32) = .58, p < .01$, revealing a difference among frame conditions, $F(2, 31) = 5.63, p = .008$. As predicted, deadlines in the little time remaining condition felt closer than in the other two conditions (Tukey’s HSD, $ps < .05$), whereas the lots of time remaining

⁵ Question framing was merely exploratory, as we mentioned, and we had no specific hypotheses for this variable in our research. Nonetheless, interested researchers might still profit from testing the possible role of question framing in the future, as admittedly some of our cell sizes were small (i.e., $ns = 5-6$). Of course, Buehler and Griffin (2003) did not find any effects of question framing in their research either.

and control conditions did not differ from each other.

Listed Thoughts About Success

We had groups list thoughts, instead of rating how easily they came to mind as was done in Study 1. Nonetheless, our predictions were similar. We simply counted and recorded the numbers of thoughts about success generated by groups. Fewer thoughts about success should have been listed in the little time remaining condition. As we predicted, there were framing differences, $F(2, 31) = 4.10, p = .026$, with fewer thoughts about successful task completion listed in the little time remaining condition than in the other two conditions (Tukey's HSD, $ps < .05$).

In summary, building conceptually on Study 1 in a controlled laboratory setting, temporal framing again influenced the group planning fallacy. The discrepancy between predicted and actual task completion times was smaller in the little time remaining frame condition than in the other two conditions. Study 2 obtained this result using a different task and another measure of accessible thoughts about successful task completion (numbers of thoughts listed), adding generality to our ideas. As in Study 1, we explored whether accessible success thoughts influence the planning fallacy using mediation analyses. First, regressing task completion time (difference) on temporal frame condition (contrast coded as in Study 1) was significant ($\beta = .37, p = .034$). Second, regressing accessible success thoughts (thought numbers) on temporal frame was significant ($\beta = .39, p = .025$). Third, regressing task completion time on both accessible success thoughts and temporal frame revealed success thoughts to be significant ($\beta = .35, p = .049$), but temporal frame was no longer significant ($\beta = .23, p = .18$). The relation between task completion time and temporal frame was marginally reduced with accessible success thoughts included (Sobel $z = 1.52, p = .10$). Overall, there was thus some evidence consistent with the idea of mediation as we predicted. The framing of the prediction question did not affect our results in this study. Again we emphasize that temporal frames influenced the group planning fallacy even though the actual time to the 1-hr deadline was held constant for all groups.

Study 3: Not Just the Thought (Content) That Counts

Our third study examined some final issues. We hypothesized that *ease of bringing to mind* thoughts about successful task completion was an underlying mechanism. Study 1 found evidence for this when accessible thoughts about success were measured on rating scales, and Study 2 when differing thought numbers were listed. Although both may generally index thought accessibility, as outlined in our introduction, the importance of distinguishing further between thought ease and numbers is seen critically when ideas about accessibility experiences (ease of thought generation) and accessible content (topic of thoughts) are considered (Sanna, Schwarz, & Stocker, 2002; Schwarz, 1998). Prior planning fallacy research has thus far emphasized only the content of people's thoughts (e.g., Buehler et al., 1994), but considering the role of accessibility experiences may produce effects that are opposite to what would be expected on the basis of thought content alone (Sanna, Schwarz, & Small, 2002). Study 3 was designed to test more directly the potentially critical role of accessibility experiences in the group planning fallacy by varying thought ease and numbers factorially. In short, we predicted that it is not just thoughts about success per se that matter: The group planning fallacy should occur only when thoughts about successful task completion are easily brought to mind. In contrast, when thoughts about success are difficult to bring to mind, the planning fallacy should be reduced.

In Study 3, we also explored whether ease of thinking about successful task completion can reciprocally influence the perceived closeness of deadlines and whether this affects the group planning fallacy. As we described, several theorists suggest that narrowly thinking about success produces the planning fallacy, and other research indicates that thinking about success is more difficult with proximal tasks (Gilovich et al., 1993; Sanna, 1999; Shepperd et al., 1996). Reversing this, in Study 3, we also explored whether difficulty in thinking about success may be associated with deadlines feeling subjectively closer and an attenuated group planning fallacy. We had two-person groups assemble computer desks while assigned to conditions of a 2 (thoughts focus: successful, unsuccessful) \times 2 (thoughts number: 5, 15) between-

groups factorial.⁶ For comparison purposes, we also included a nonfactorial control condition in which groups did not list any thoughts. Finally, Study 3 adds to prior research in another way, because the role of thought accessibility has not been examined with groups before.

Method

Participants

One hundred students enrolled in introductory psychology courses received extra credit and were randomly assigned to one of 50 two-person groups.

Procedure

Groups arrived at the laboratory and assembled a computer desk with procedures identical to Study 2 except as noted below.

Thoughts Listing

We did not manipulate temporal frames directly but instead varied thoughts about successful task completion while assessing their influence on frames (i.e., subjective closeness of deadlines). The thoughts-listing task was modeled after prior research (Sanna et al., 2002; Schwarz, 1998). Only groups in the factorial portion of the design listed thoughts before making predictions. Groups were given a page on which to list thoughts that was similar to that used in Study 2. However, those in the successful focus condition were asked to “use the spaces below to list 5 [or 15] reasons for possible successful task completion.” Groups in the unsuccessful focus condition read an analogous prompt about listing reasons for possible unsuccessful task completion. Within thoughts focus, instructions varied only by whether participants provided 5 (5-thoughts condition) or 15 (15-thoughts condition) thoughts.

As a manipulation check, groups in the thoughts-listing conditions rated the degree of difficulty they had in listing thoughts on two 11-point scales ($-5 = \textit{very difficult}$, $0 = \textit{neither difficult nor easy}$, $5 = \textit{very easy}$; and $-5 = \textit{very hard}$, $0 = \textit{neither hard nor simple}$, $5 = \textit{very simple}$). We used bipolar scales in Study 3 for further generality. The actual numbers of thoughts listed by groups were also recorded.

Dependent Measures

Dependent measures were completed jointly as a group and were similar to our first two studies with the following exceptions.

Predicted task completion. In Studies 1 and 2, groups predicted task completion on somewhat constrained devices (i.e., a calendar and clock face, respectively). Although we do not believe this was problematic, in Study 3 we instead used an open-ended measure. Groups were asked simply to write down how long it would take them to finish assembling the desk.

Subjective temporal distance. Subjective temporal distance was rated on two 11-point bipolar scales ($-5 = \textit{feels very close}$, $0 = \textit{neither close nor far}$, $5 = \textit{feels very far}$; and $-5 = \textit{feels very near}$, $0 = \textit{neither near nor distant}$, $5 = \textit{feels very distant}$).

Results and Discussion

We conducted 2×2 ANOVAs with simple effects tests on the factorial portion of the data. Comparisons with the nonfactorial control condition were made using the Dunnett procedure (Winer, Brown, & Michels, 1991). Means and standard deviations are presented in Table 3.

Manipulation Checks

In the factorial portion of the design, groups listed thoughts and rated their difficulty. Groups in the 5-thoughts condition listed 5 thoughts ($M = 5.00$, $SD = 0.00$), whereas those in the 15-thoughts condition listed an average of 12.52 ($SD = 2.11$).⁷ An ANOVA on the average of the two thoughts-listing difficulty manipulation checks, $r(38) = .72$, $p < .01$, revealed that groups in the 15-thoughts condition ($M = -2.15$, $SD = 2.10$) also rated the thoughts-listing task as more difficult than groups in the 5-thoughts condition ($M = 2.80$, $SD = 2.04$), $F(1, 36) = 53.34$, $p < .001$. Thus, our thoughts-listing manipulations were effective.

⁶ Pairs were used simply for practical reasons, but this added generality to our research by demonstrating effects regardless of group size (four-, three-, and two-person groups) across our three studies. Pilot testing had indicated that listing 5 thoughts about successful or unsuccessful task completion was easy and listing 15 thoughts was difficult for pairs to accomplish.

⁷ Because the standard deviation in the 5-thoughts condition was effectively zero, reporting ANOVA results for this comparison would have been inappropriate.

Table 3
Task Completion Time (Minutes Before Deadline) and Subjective Temporal Distance by Thoughts Listing for Study 3

Measure	Thoughts listing (factorial portion)				Control (nonfactorial portion)	
	Successful focus		Unsuccessful focus		M	SD
	M	SD	M	SD		
	5 thoughts (easy)				No thoughts listing	
Task completion time						
Difference	10.11	7.90	2.83	7.08	10.86	6.41
Predicted	43.00	4.44	50.20	4.58	42.30	4.57
Actual	53.11	5.56	53.03	5.79	53.16	5.09
Subjective temporal distance	1.90	2.23	-1.80	2.65	1.80	1.68
	15 thoughts (difficult)					
Task completion time						
Difference	2.10	6.04	13.05	8.52		
Predicted	49.60	4.62	40.60	4.52		
Actual	51.70	5.68	53.65	5.33		
Subjective temporal distance	-2.20	1.93	1.70	2.21		

Note. $n = 10$ groups per cell. Difference = actual minus predicted task completion time.

Dependent Measures

Task completion time. Following Studies 1 and 2, the group planning fallacy was indexed by subtracting predicted from actual task completion times. These times were again converted to minutes (and fractions thereof) before the 1-hr deadline. First, we conducted a 2×2 ANOVA on the difference, revealing only an interaction, $F(1, 36) = 14.98, p < .001$. Simple effects tests indicated that the group planning fallacy was greater when thoughts about successful task completion were easy to bring to mind than when they were difficult, $F(1, 18) = 6.47, p = .02$, whereas the opposite occurred when thoughts about unsuccessful task completion were easy versus difficult to bring to mind, $F(1, 18) = 8.51, p = .009$.

Second, we made comparisons with the nonfactorial control condition. Groups who had a difficult time thinking about successful, and those who had an easy time thinking about unsuccessful, task completion exhibited lesser planning fallacy (Dunnett's test, $ps < .05$). The control condition did not differ from the remaining two conditions.

As in our first two studies, our manipulations mainly affected the group's predicted completion time. An ANOVA revealed an interaction, $F(1, 36) = 31.73, p < .001$, with comparisons with the nonfactorial control conforming to

those for the difference index (Dunnett's test, $ps < .01$). Actual task completion times were unaffected (ANOVA, $F_s < 1$; Dunnett's test, $ps > .50$).

Subjective temporal distance. The two subjective temporal distance questions were averaged, $r(38) = .67, p < .01$. First, an ANOVA revealed only an interaction, $F(1, 36) = 27.91, p < .001$. Simple effects tests indicated that deadlines felt more distant when thoughts about successful task completion were easy to bring to mind than when they were difficult, $F(1, 18) = 19.27, p < .001$, whereas the opposite occurred when thoughts about unsuccessful task completion were easy versus difficult to bring to mind, $F(1, 18) = 10.23, p = .005$.

Second, as predicted, comparisons with the nonfactorial control condition indicated that groups who had a difficult time thinking about successful, and those who had an easy time thinking about unsuccessful, task completion viewed deadlines as more proximal (Dunnett's test, $ps < .01$). The control condition did not differ from the remaining two conditions.

In summary, Study 3 provides strong evidence that it is not just thoughts about successful task completion per se that matter. First, thinking about successful task completion was related to the group planning fallacy as expected, but only when those thoughts were easy

to bring to mind. In contrast, as we also predicted, when thinking about successful task completion was difficult for groups, the planning fallacy was reduced, despite the fact that in the 15-thoughts success conditions they listed more reasons for possible success. This is important because prior planning fallacy research has thus far focused mainly on thought content (Buehler et al., 1994). But a focus on thought content alone misses the critical role of accessibility experiences in understanding the planning fallacy. Second, the opposite was true for thoughts about unsuccessful task completion: There was less planning fallacy when such thoughts were easy to bring to mind and more planning fallacy when such thoughts were difficult to bring to mind. This provides even more evidence for the critical role of accessibility experiences by suggesting that it is not thought content alone that matters. These latter findings also have intriguing implications for debiasing the planning fallacy. Thinking about unsuccessful task completion may help to debias the planning fallacy, but only to a point. Too many thoughts about unsuccessful task performance may backfire (Sanna et al., 2002). Once again, these findings were obtained even though deadlines were objectively equivalent across groups.

General Discussion

Our three studies provide converging evidence for a previously untested hypothesis that temporal frames can influence the group planning fallacy and that this is associated with subjective distance to deadlines and thoughts about successful task completion. We found this for students' responses to real-life course projects (Study 1) and for laboratory desk-assembly tasks (Studies 2 and 3). Support for our hypotheses was obtained when task completion was predicted over several weeks (Study 1) and within an hour (Studies 2 and 3) and whether predictions were made using constrained (Studies 1 and 2) or open-ended (Study 3) formats. The planning fallacy occurred whether groups were composed of two (Study 3), three (Study 2), or four (Study 1) members. Thoughts about successful task completion were made on rating scales (Study 1), were listed (Study 2), and were manipulated (Study 3); and questions were answered on unipolar scales (Studies 1 and 2) and bipolar scales (Study 3). In short, across three studies in which we used diverse settings, ma-

nipulations, and measures, findings converged, lending strong support for our hypotheses.

Group Planning and Temporal Frames

We began by outlining three novel and unique goals of our research, and we end by discussing our findings in this context. First, we tested whether temporal frames influence the group planning fallacy. All three studies clearly indicated that they do. It is important that frames affected planning estimates even though actual target dates or deadlines were held constant across groups. This lends strong support for the role of temporal framing in this process, as it indicates that it is not simply the objective amount of time available for task completion that was at issue. Of course, we are not suggesting that objective amount of time is irrelevant. It certainly is very relevant. However, our research was designed to demonstrate framing effects independent of actual temporal distance from deadlines or target dates. As such, we suggested that time can be framed beginning with starting or stopping points (Paese, 1995), with different psychological implications. Groups can begin with starting points as referents and move forward in time, leading them to perceive lots of time remaining and leaving the planning fallacy intact, or they can begin with stopping points as referents and move backward in time, leading them to perceive little time remaining and reducing the planning fallacy. The finding that groups rated deadlines as feeling closer in Studies 1 and 2 when asked to use the stopping point as a referent in the little time remaining conditions provides some initial evidence for this process. Frames clearly influenced performance. Further identifying the precise mechanism underlying this effect certainly is an intriguing question for future research.

Second, despite vivid public illustrations of large-scale planning fallacy (the Sydney Opera House, the Eurofighter, Boston's Central Artery/Tunnel, and many others; Flyvberg et al., 2002; Hall, 1980; Schnaars, 1989), researchers had focused mainly on plans of individual persons rather than groups. Our research fills this gap. All three studies indicated that the planning fallacy occurs at the group level, providing direct empirical evidence for this possibility rather than relying on observational anecdotes alone. This demonstration is important because although in many cases groups may be suscep-

tible to the same biases as individuals, in other cases they may not be (Hinz et al., 1997; Kerr et al., 1996). As such, our research adds to the evidence supporting the robustness of the planning fallacy across levels and for a variety of tasks and contexts (Buehler et al., 1994; Byram, 1997; Kahneman & Tversky, 1979; Kruger & Evans, 2004; Newby-Clark et al., 2000; Sanna & Schwarz, 2004; Taylor et al., 1998). Likewise, our three studies add to the small body of group framing research (Hinz et al., 1997; Kerr et al., 1996; Paese, Bieser, & Tubbs, 1993; Tindale et al., 1993), none of which had examined hypotheses put forth in our experiments. Each of these features may represent an important contribution to the literature on planning fallacy, group biases, and framing effects.

Third, we tested subjective temporal distance and accessible thoughts about successful task completion as underlying mechanisms. At the individual level, several reasons for the planning fallacy have been proposed. Many have in common the idea that people think too narrowly about successful future plans (Buehler & Griffin, 2003; Kahneman & Tversky, 1979; Kruger & Evans, 2004), emphasizing *what* people think about—thought content. However, our studies add to this by indicating that it is accessibility experiences (Schwarz, 1998) and not just thoughts about success per se that matter. In particular, when we manipulated thought numbers and thought accessibility in Study 3, we found that thoughts about successful task completion increased the group planning fallacy only when brought to mind easily. When such thoughts were difficult, the planning fallacy was reduced, even though over twice as many thoughts were listed. Moreover, the opposite pattern was obtained with thoughts about unsuccessful task completion, providing even stronger evidence for the critical role of accessibility experiences in this process. It is interesting that simply thinking about pessimistic alternatives has met with mixed effectiveness in debiasing the planning fallacy in prior research (Buehler et al., 1994; Newby-Clark et al., 2000), and Study 3 may begin to further suggest why.

Possible Future Directions

Our research provides several important initial pieces of the puzzle relating to the group planning fallacy. However, as with most psychological phenomena, we suspect there is more

to the story, and many intriguing directions likely remain for future researchers. We tested whether temporal frames influenced the group planning fallacy, and across all three studies groups made predictions jointly. It was not our purpose to assess the types of discussions or decision rules that might have been used by groups to arrive at their conclusions. The group planning fallacy importantly was produced, and reduced, in our research nonetheless. However, one interesting possibility would be to focus on the specific discussion and decision rules used by groups. For example, diverse decision schemes (Davis, 1973; Stasser, Kerr, & Davis, 1989) could be used, and this might be related to the group planning fallacy. Related possibilities involve varying the framing composition of groups (e.g., constructing groups from individuals with differing frames; Tindale et al., 1993) and directly comparing the planning fallacy of groups with individuals.

Little time remaining frames led to deadlines feeling subjectively closer and to fewer thoughts about successful task completion. Results of Study 3, the first study to vary accessibility experiences with groups (Schwarz, 1998), suggested this was due to how easily thoughts about successful task completion are brought to mind. However, prior research indicates that the planning fallacy is complex and likely multiply determined. As evidence that the group planning fallacy may be multiply determined, the mediational analyses of Studies 1 and 2 indicated that accessible thoughts about successful task completion may mediate the group planning fallacy, although they might not do so fully. We can thus speculate about other potentially relevant variables. For example, our framing manipulations might have influenced temporal construal (Sagristano, Trope, & Liberman, 2002; Trope & Liberman, 2003). Groups with little time remaining frames may have viewed deadlines concretely, whereas those with lots of time remaining frames may have viewed deadlines abstractly. Groups with little time remaining frames may have also appraised positive outcomes (e.g., meeting the deadline) as subjectively closer (Ross & Wilson, 2002; Sanna, Chang, & Carter, 2004), and in fact the subjective distance measures in Studies 1 and 2 provide some evidence for this. Little time remaining frames may have additionally induced time pressure (Kelly & Loving, 2004; Parks & Cowlin, 1995), narrowing groups' attention to the

deadlines. Each of these possibilities may be worthy of future research, particularly given the finding that although predictions were affected, actual task completion time was not.

As the cliché states, there is so much to do and so little time in which to do it. Our research suggests that framing deadlines in terms of little time remaining can decrease the group planning fallacy, in the sense of creating smaller discrepancies between predicted and actual task completion times. It also suggests that groups (and perhaps individuals too) may naturally conceive of the hourglass as half full rather than half empty. That is, groups with lots of time remaining frames (Studies 1 and 2) and groups who found thoughts about successful task completion easy to bring to mind (Study 3) matched the pattern observed in the control conditions. Other research similarly provides some evidence that seeing the task as proximal increases completion time predictions (Byram, 1997) and that this makes thinking about success difficult (Gilovich et al., 1993; Sanna, 1999; Shepperd et al., 1996). In fact, it seems that groups can make either overly optimistic or overly pessimistic predictions depending on a host of task-related variables (Connolly & Dean, 1997). We believe that at least part of the answer for these apparently divergent results may lie in the differing temporal frames that groups bring to bear on predicted task completion times. Of course, it is up to future researchers to test these ideas more completely. From our current perspective in framing these issues, however, we believe that more answers to these intriguing questions will come sooner rather than later.

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